MOSE COMPOSITION SURVEY, KOBUK VALLEY NATIONAL PARK, ALASKA - November 2009

BRAD S. SHULTS, U. S. National Park Service, Western Arctic National Parklands, P.O. Box 1029, Kotzebue, AK 99752

DATA SUMMARY

Survey Dates: *16-22 November 2009*
Survey Area: *2,546 mi^2 (6,594 km^2)*
Total Moose Observed: *233*
Average Search Effort: *5.1 min/mi^2*
Bull : 100 Cow Ratio Estimate: *64:100 (80% CI ± 19%)*
Calf : 100 Cow Ratio Estimate: *36:100 (80% CI ± 39%)*
Population Estimate: *1,672 moose (80% CI ± 31%)*
Density Estimate: *0.7 moose/mi^2 (0.3 moose/km^2)*

INTRODUCTION

Moose population monitoring in northwest Alaska has been a cooperative effort with the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service, and the Bureau of Land Management. More recently, moose population monitoring was chosen as 1 of 28 vital signs that will be monitored as part of the NPS Vital Signs Monitoring Plan within the Arctic Network park units (i.e., Bering Land Bridge National Preserve, Cape Krusenstern National Monument, Gates of the Arctic National Park and Preserve, Kobuk Valley National Park, and Noatak National Preserve)(Lawler et al. 2009). Population monitoring objectives will include the geospatial population estimator (GSPE) to estimate moose abundance and recruitment during late winter/spring coupled with GSPE or stratified, simple random sample estimators to estimate fall calf: cow and bull: cow ratios within the same areas. The current, cooperative monitoring strategy is to conduct a population abundance survey in the lower Kobuk River drainage every 3-5 years and sex/age composition surveys during the prior October/November in the same area.

Moose populations within Unit 23 have been at low densities (<1 moose/mi^2) since the early 1990s (Dau 2008). Population abundance and sex/age composition has been monitored with both quantitative (i.e., statistical estimators) and qualitative (i.e., fall/spring trend counts) methods in several major drainages across the unit (Fig. ?census areas). The area within Kobuk Valley National Park (KOVA) is contained within the Lower Kobuk River population monitoring area (Fig.). The first fall population abundance/composition censuses were completed in 1995 and 1997 in an area encompassing the eastern side of the Kallarichuk Hills, Salmon River, Tutuksuk River, and Kobuk River (Fig. 1)(citations). Prior to 1995, there were no statistical estimates of abundance or sex/age ratios for the Lower Kobuk River area.

The KVNP is closed to sport hunting and most subsistence harvest occurs close to local villages such as Ambler, Kiana, and Noorvik or along the Kobuk River corridor via boat and snow machine. Harvest is assumed to be a minor factor limiting moose abundance in this area. With this in mind, monitoring this population will provide abundance and sex/age ratio data that serve as a comparison for more heavily harvested drainages within northwestern Alaska such as the Noatak, Squirrel, Selawik, and Tagagawik River drainages.

STUDY AREA

The survey area was delineated from the lower Kobuk River moose population monitoring area that was previously surveyed during Spring 2006. We selected a small area to sample within the constraints of limited fall daylight and favorable weather so only sample units that were east of the western boundary of Kobuk Valley National Park were included in this survey (Fig. 2). The survey area is predominantly federal public land within Kobuk Valley National Park. Private landowners include NANA Corporation and native allotments especially along the Kobuk River and near the village of Ambler.

METHODS

Stratification and Sampling

We conducted a stratified random sample survey using field and analysis methods of Gasaway et al. (1986) and VerHoef (2001). Sample units were chosen from the standardized grid of sample units for GSPE surveys (Kellie and Delong 2006). Standard sample units were 2 min latitude by 5 min longitude and averaged 5.2 mi^2 (13.5 km^2). Sample units were stratified into a high (i.e. ≥1 moose) or low (i.e. 0 moose) density stratum. We stratified *a priori* the western portion of the census area using the results of the 1995 and 1997 stratification, and the remaining units based on suitability as early winter moose habitat. Sample units were randomly selected for sampling, and sampled in order of selection. Sample units were surveyed using tandem seat aircraft (PA-18, Husky, Scout). Target search time for each unit was 6 min/mi^2. Latitude and longitude locations of observed moose groups were recorded with an onboard GPS receiver. Total number of moose as well as sex, age, and bull antler size class was recorded for each group. Moose were classified as cow, calf, small bull (spike or forked antlers), medium bull (>spike/fork and < 50 inch [127 cm] spread), large bull (≥50 inch [127 cm] spread) or unknown sex and/or age.

Statistical Analyses

Population and ratio parameters were estimated with stratified random sample estimators (i.e. “Gasaway estimators”) using the web-based software developed for GSPE moose surveys (DeLong 2006).

RESULTS

We conducted the survey between 16 November and 22 November 2009. Survey conditions were optimal (i.e. clear sky, light wind, fresh and complete snow cover)(Fig ? and ?). Sample units were surveyed in approximately 27.5 hrs. Participants in the survey included 2 FWS, 4 NPS, and 1 ADFG employees with prior moose survey experience.

Sample Units

The 2,546 mi^2 (6,594 km^2) census area was stratified into 328 low (66%) and 166 high (34%) density units. We surveyed 63 of the 494 units [13%; area= 325 mi^2 (842 km^2)]. We surveyed 51 high density units and 12 low density units. The GSPE requires a minimum of 20 sample units/stratum. Lacking the minimum sample size, I calculated all estimates using the stratified random sample estimators (Gasaway et al. 1986). No intensive surveys for sightability correction were completed since population estimation was not the primary objective. The mean standard search intensity was 5.1 min/mi^2 (2.0 min/km^2).

Population Estimation and Sex/Age Ratios

We counted 233 moose classified as 76 bulls, 117 cows, and 40 calves. The estimated bull: cow ratio was 64:100 (80% CI ± 19%). Bull antler size classes were estimated to be 21%

small, 49% medium, and 30% large. The estimated calf: cow ratio was 36:100 (80% CI ± 39%)(Tables 6 and 7). The population estimate of 1,672 moose (80% CI ± 31%) results in a density estimate of 0.7 moose/mi^2 (0.3 moose/km^2)(Table 2).

DISCUSSION

The primary objective of the fall survey was to calculate calf: cow and bull: cow ratios.
The calf: cow ratio is an index of productivity and pre-winter survival. The bull: cow ratio is a subjective criterion with which to evaluate the effects of harvest when the harvest is male biased, but is particularly sensitive to changes in annual female mortality (Bender). Both ratios when combined with spring recruitment estimates, can be used to calculate maximum sustainable mortality rates for males and females (Bender).

The bull:cow ratio reflects the lack of a significant harvest effect and is % higher than the Noatak river population. The cow:calf ratio is near the long-term mean for the Noatak and Squirrel river moose census areas.

LITERATURE CITED

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Table 1. Sample unit data for the Kobuk Valley National Park moose census, November 2009.

[a] Bull antler size classes: S=small (<25 in), M=medium (26-50 in), and L=large (>50 in)
[b] Cow associations: 0=no calf, 1=1 calf, 2=2 calves.

APPENDIX A.

RESULTS	

Ratio Estimate

Ratio Estimate:	0.639765
Standard Error:	0.09123054
Degrees of Freedom:	14.00373

Confidence Intervals

Confidence	Interval (moose)	Interval (proportion of the mean)
80%	0.5170588 0.7624712	0.1917989
90%	0.4790827 0.8004472	0.2511582
95%	0.4440998 0.8354301	0.3058391

Numerator Estimate

Numerator Estimate:	535.7899
Standard Error:	139.1080
Degrees of Freedom:	14.09564

Confidence Intervals

Confidence	Interval (moose)	Interval (proportion of the mean)
80%	348.7483 722.8315	0.3490951
90%	290.8950 780.6847	0.4570725
95%	237.6228 833.9570	0.5565

Denominator Estimate

Denominator Estimate:	837.4792
Standard Error:	164.4048
Degrees of Freedom:	14.00373

Confidence Intervals

Confidence	Interval (moose)	Interval (proportion of the mean)
80%	616.3527 1058.6058	0.2640383
90%	547.9168 1127.0417	0.3457548
95%	484.8748 1190.0837	0.4210307

SAMPLE DETAILS

Total Samples	Total Area	Numerator Counted
stratum sample.sizes 1 HIGH 166 2 LOW 328	stratum total.area 1 HIGH 856.990 2 LOW 1689.356	stratum counted 1 HIGH 64 2 LOW 12
Sample Sizes	**Area Sampled**	**Denominator Counted**
stratum sample.sizes 1 HIGH 51 2 LOW 12	stratum sampled.area 1 HIGH 263.169 2 LOW 61.923	stratum counted 1 HIGH 98 2 LOW 19

ESTIMATE DETAILS

	Mean Density	Stratum Estimates	Stratum Variances

Numerator	stratum mean.density 1 HIGH 0.2431897 2 LOW 0.1937891	stratum total.estimate 1 HIGH 208.4112 2 LOW 327.3787	stratum total.variance 1 HIGH 2290.248 2 LOW 17060.775
Denominator	stratum mean.density 1 HIGH 0.3723843 2 LOW 0.3068327	stratum total.estimate 1 HIGH 319.1296 2 LOW 518.3496	stratum total.variance 1 HIGH 3118.228 2 LOW 23910.719
Stratum Covariances	stratum covariance 1 HIGH 1419.814 2 LOW 17787.573		

RESULTS

Ratio Estimate	
Ratio Estimate:	0.3563467
Standard Error:	0.1021043
Degrees of Freedom:	12.19113

Confidence Intervals		
Confidence	Interval (moose)	Interval (proportion of the mean)
80%	0.2179973 0.4946961	0.3882439
90%	0.1746048 0.5380885	0.5100142
95%	0.1342667 0.5784267	0.6232134

Numerator Estimate	
Numerator Estimate:	298.4329
Standard Error:	117.8835
Degrees of Freedom:	12.19113

Confidence Intervals		
Confidence	Interval (moose)	Interval (proportion of the mean)
80%	138.7030 458.1628	0.5352289
90%	88.6047 508.2612	0.7031001
95%	42.03268 554.83317	0.8591553

Denominator Estimate	
Denominator Estimate:	837.4792
Standard Error:	164.4048
Degrees of Freedom:	14.00373

Confidence Intervals		
Confidence	Interval (moose)	Interval (proportion of the mean)
80%	616.3527 1058.6058	0.2640383
90%	547.9168 1127.0417	0.3457548
95%	484.8748 1190.0837	0.4210307

SAMPLE DETAILS

Total Samples	Total Area	Numerator Counted
stratum sample.sizes 1 HIGH 166 2 LOW 328	stratum total.area 1 HIGH 856.990 2 LOW 1689.356	stratum counted 1 HIGH 33 2 LOW 7
Sample Sizes	**Area Sampled**	**Denominator Counted**
stratum sample.sizes 1 HIGH 51 2 LOW 12	stratum sampled.area 1 HIGH 263.169 2 LOW 61.923	stratum counted 1 HIGH 98 2 LOW 19

ESTIMATE DETAILS

	Mean Density	Stratum Estimates	Stratum Variances
Numerator	stratum mean.density 1 HIGH 0.1253947 2 LOW 0.1130436	stratum total.estimate 1 HIGH 107.4620 2 LOW 190.9709	stratum total.variance 1 HIGH 700.413 2 LOW 13196.113

Denominator	stratum mean.density 1 HIGH 0.3723843 2 LOW 0.3068327	stratum total.estimate 1 HIGH 319.1296 2 LOW 518.3496	stratum total.variance 1 HIGH 3118.228 2 LOW 23910.719
Stratum Covariances	stratum covariance 1 HIGH 922.18 2 LOW 13132.59		

RESULTS

Estimate	
Population Estimate:	1671.702
Standard Error:	381.9432
Degrees of Freedom:	12.89509

Confidence Intervals

Confidence	Interval (moose)	Interval (proportion of the mean)
80%	1155.789 2187.615	0.3086155
90%	994.8851 2348.5190	0.404867
95%	845.8811 2497.5229	0.4940001

SAMPLE DETAILS

Total Samples

```
  Stratum   N
1    HIGH 166
2     LOW 328
3   TOTAL 494
```

Total Area

```
  Stratum     Area
1    HIGH  856.990
2     LOW 1689.356
3   TOTAL 2546.346
```

Sample Sizes

```
  Stratum  n
1    HIGH 51
2     LOW 12
3   TOTAL 63
```

Area Sampled

```
  Stratum    Area
1    HIGH 263.169
2     LOW  61.923
3   TOTAL 325.092
```

Moose Counted

```
  Stratum
Counted
1    HIGH
195
2     LOW
38
3   TOTAL
233
```

ESTIMATE DETAILS

Mean Density

```
  stratum
Estimate
1    HIGH
635.0028
2     LOW
1036.6993
```

Stratum Estimates

```
  Stratum
Density
1    HIGH
0.7409687
2     LOW
0.6136654
```

Stratum Variances

```
  stratum   Variance
1    HIGH   11248.57
2     LOW  134632.00
```

Sampling and Stratification